Meade® Smart Drive™

Permanent Periodic Error Correction (PPEC) for Meade LX200GPS Telescopes

Included as *standard equipment* with all Meade LX200GPS Schmidt-Cassegrain telescopes, and with the #1664 and #1697 drive systems of Meade apochromatic refractors *(p. 56)* as well, the Smart Drive permits a professional level of drive-rate precision. No longer are large worm gear systems required, when smaller gears coupled to Smart Drive software can achieve periodic errors of 5 arc secs or less—an observatory standard of precision.

Smart Drive programming is done through the telescope's hand controller.

All worm/worm-gear combinations, no matter how well made, have minor inaccuracies that manifest themselves as periodic errors in the telescope tracking rate, with the period dependent on the worm's rate of rotation. To program the Smart Drive, the observer guides on an object visually, making corrections with the handbox controller. The software then remembers these keystrokes, stores them in memory, and in the future *automatically* compensates for the periodic errors of the gear system.

Smart Drive user programming is stored in the telescope's computer memory forever, independently of any power source, unlike other periodic error correctors that must be reprogrammed each time you use the system. The Smart Drive can be erased, updated, or even averaged with future programmings at the user's option.

The significant value of the Smart Drive is immediately appreciated during long-exposure astrophotography, where the resultant low periodic error of the system enables relaxed guiding with a minimum of handbox corrections. In CCD imaging, where 2- to 3-minute exposures of deep-space objects are often all that is required for stunning results, the Smart Drive often permits imaging without any guiding requirements at all.

The Smart Drive is a tremendous aid in obtaining high-quality, long-exposure images, such as this 2-hour exposure of the Spiral Galaxy (M81) in Ursa Major by Philip Perkins.

Meade® Model 1220 Field De-rotater

for Meade LX200GPS Telescopes

Meade LX200GPS telescopes may be operated in the altazimuth mode (*i.e.,* without polar alignment) for all visual applications and for photographic or CCD imaging exposures of up to about five minutes' duration. Most LX200GPS owners use their telescope in the altazimuth mode the great majority of the time. During longer photo or CCD exposures in the altazimuth mode, however, an effect called *field rotation* becomes evident.

Meade #1220 Field De-rotater *(arrow),* shown with #62 T-Adapter and 35mm camera body attached to a Meade 10" LX200GPS, ready for long-exposure astrophotography.

Simply put, even if the telescope is *perfectly* guided on a central star during a long exposure, stars at the edge of the field appear to rotate about the field center during the exposure. As a result, stars away from the field center appear as small concentric arcs on the film, rather than star-points. This effect, which in no way relates to the accuracy of the telescope's computer or internal alignment, occurs on all altazimuth-mounted telescopes, whether large observatory telescope or LX200GPS, and is caused by the telescope not being polar aligned.

Field rotation with an LX200GPS (or with their predecessor LX200 models) can be cured with the simple addition of an equatorial wedge (see, *e.g.,* p. 18, 29, or 39); the wedge enables precise polar alignment, negating all field rotation. Alternately, the optional #1220 Field De-rotater may be attached to the rear cell of any 7", 8", 10", or 12" Meade LX200 or LX200GPS model, simplifying field operation of the telescope, since no wedge is required. With the #1220 De-rotater attached to the telescope's rear cell, other accessories (T-Adapter, Off-Axis Guider, etc.) can in turn be threaded to the #1220 unit.

The #1220 is easy to use! Just align the LX200GPS telescope as usual, using the GPS alignment procedure or one of six other available alignment procedures, and, automatically, signals are fed through one of the RS-232 ports on the LX200GPS control panel to the Field De-rotater, causing it to rotate at the correct speed and precisely counter the effects of altazimuth-induced field rotation. The #1220 Field De-rotater is powered through connection with the RS-232 serial port.

Specifications and Features: Meade 8" LX90; 7", 8", and 10" LX200GPS Telescopes

TELESCOPE:	8" LX90	7" LX200GPS	8" and 10" LX200GPS
Optical Design	Schmidt-Cassegrain	Maksutov-Cassegrain	Schmidt-Cassegrain
Clear Aperture	203mm (8")	178mm (7")	203mm (8"); 254mm (10")
Primary Mirror Diameter	209.6mm (8.25")	209.6mm (8.25")	209.6mm (8.25"); 263.5mm (10.38")
Focal Length; Focal Ratio	2000mm f/10	2670mm f/15	2000mm f/10 (8"); 2500mm f/10 (10")
Near Focus *(approx.)*	25 ft.	50 ft.	25 ft. (8"); 50 ft. (10")
Resolving Power (arc secs.)	0.56	0.64	0.56 (8"); 0.45 (10")
Optical Coatings	MgF_2 on correcting plate (2-sides); standard aluminum on primary & secondary mirrors	MgF_2 on correcting lens (2-sides); standard aluminum on primary & secondary mirrors	MgF_2 on correcting plate (2-sides); standard aluminum on primary & secondary mirrors
Ultra-High Transmission Coatings *(p. 26)*	optional at time of purchase	optional at time of purchase	optional at time of purchase
Limiting Visual Magnitude *(approx.)*	14.0	13.5	14.0 (8"); 14.5 (10")
Limiting Photographic Magnitude *(approx.)*	16.5	16.0	16.5 (8"); 17.0 (10")
Image Scale (degs./inch)	0.72	0.54	0.72 (8" f/10); 0.57 (10" f/10)
Maximum Practical Visual Power	600X	550X	600X (8"); 650X (10")
35mm Angular Film Coverage	0.68° x 0.97°	0.52° x 0.74°	0.68° x 0.97° (8"); 0.54° x 0.78° (10")
Optical Tube Dimensions (dia. x length)	9.1" x 16.75"	9.1" x 20.5"	9.1" x 16.75" (8"); 11.75" x 22" (10")
Secondary Mirror Obstruction (dia.; %)	3.0"–14.1%	1.9"–7.4%	3.0"–14.1% (8"); 3.7"–13.7% (10")
Telescope Mounting	fork-type; double tine	heavy-duty fork type; double tine	heavy-duty fork-type; double tine
Setting Circle Diameters	Dec: 5"; RA: 8"	Dec: 5"; RA: 8.75"	Dec: 5"; RA: 8.75"
RA Motor Drive System	9-speed, microprocessor-controlled, 12v DC servo motor; 4.9" LX worm gear	185-speed, microprocessor-controlled, 12v DC servo motor; 5.75" LX worm gear with Smart Drive software	185-speed, microprocessor-controlled, 12v DC servo motor; 5.75" LX worm gear with Smart Drive software
Hemispheres of Operation	North and South, switchable	North and South, automatically selected by GPS input or by user override	North and South, automatically selected by GPS input or by user override
Declination Control System	9-speed, microprocessor-controlled, 12v DC servo motor; 4.9" LX worm gear	185-speed, microprocessor-controlled, 12v DC servo motor; 5.75" LX worm gear with Smart Drive software	185-speed, microprocessor-controlled, 12v DC servo motor; 5.75" LX worm gear with Smart Drive software
Primary Mirror Lock	no	included (progressive tension)	included (progressive tension)
Zero-Image Shift Electric Focuser	optional	included (4-speed)	included (4-speed)
GPS Alignment	no	included (16-channel GPS receiver, electronic sensors for true-level and North, with magnetic declination compensation)	included (16-channel GPS receiver, electronic sensors for true-level and North, with magnetic declination compensation)
GO TO Pointing Precision	5-arc mins.	2-arc mins.	2-arc mins.
Pointing Precision, High-Precision Mode	3-arc mins.	1-arc min.	1-arc min.
Slow-Motion Controls	electric, RA and Dec	manual and electric, RA and Dec.	manual and electric, RA and Dec.
Bearings	Dec: 1 x 1.85" dia. ball bearing in each fork; RA: 1 x 2.25" dia. and 1 x 2" dia. ball bearings	Dec: 3 x 1.83" dia. ball bearings; RA: 1 x 4" dia. and 1 x 2.25" dia. ball bearings	Dec: 3 x 1.83" dia. ball bearings; RA: 1 x 4" dia. and 1 x 2.25" dia. ball bearings
Autostar Hand Controller	PIC 16C57 microcontroller; 2 line x 16 alphanumeric character display; 20-button keypad, red LED backlit	Atmel 89C451 & PIC16C57 microcontrollers; 2 line x 16 alphanumeric character display; 20-button keypad, red LED backlit	Atmel 89C451 & PIC16C57 microcontrollers; 2 line x 16 alphanumeric character display; 20-button keypad, red LED backlit
Main Telescope Controller	Motorola 68HC11 microprocessor; 1-Megabyte flash memory (field reprogrammable); 32K RAM	distributed intelligence architecture using 8 networked microcontrollers (Motorola 68HC11, Atmel 89C451, 3 x PIC16C62, 2 x PIC16C54, Sony digital signal processor); 3.5-Megabyte flash memory (field reprogrammable), 32K RAM	distributed intelligence architecture using 8 networked microcontrollers (Motorola 68HC11, Atmel 89C451, 3 x PIC16C62, 2 x PIC16C54, Sony digital signal processor); 3.5-Megabyte flash memory (field reprogrammable), 32K RAM
Batteries *(user-supplied)* [Note 1]	8 x C-cells	8 x C-cells	8 x C-cells
Battery Life *(approx.)*	60 hrs.	20 hrs.	20 hrs.
Onboard Celestial Object Database	30,223 objects	147,541 objects	147,541 objects
Slew Speeds	RA and Dec: 1x, 2x, 8x, 16x, 64x, 128x sidereal and 1.5°/sec., 3°/sec., 6.5°/sec.	RA and Dec: 0.01x to 1.0x sidereal, variable in 0.01x increments; 2x, 8x, 16x, 64x, 128x sidereal; 1°/sec. to 8°/sec., variable in 0.1° increments	RA and Dec: 0.01x to 1.0x sidereal, variable in 0.01x increments; 2x, 8x, 16x, 64x, 128x sidereal; 1°/sec. to 8°/sec., variable in 0.1° increments
Tracking Rates	sidereal, lunar, or custom-selected from 2000 incremental rates	sidereal, lunar, or custom-selected from 2000 incremental rates	sidereal, lunar, or custom-selected from 2000 incremental rates
Materials: Tube Body	aluminum	aluminum	aluminum
Mount Castings	aluminum	aluminum	aluminum
Primary, Secondary Mirrors [Note 2]	Pyrex® glass	Pyrex® glass	Pyrex® glass
Correcting Plate/Lens	clear float glass	BK7 optical glass	clear float glass
Telescope Dimensions, swung down	9.25" x 17" x 24.75"	9.25" x 17" x 34"	9.25" x 17" x 24.75" (8"); 12" x 20" x 31" (10")
Shipping Carton Dimensions	21" x 30" x 14"	38" x 22" x 14"	31" x 22" x 14" (8"); 38" x 26" x 18" (10")
Total Net Telescope Weight	53 lbs.	84 lbs.	73 lbs (8"); 90 lbs.(10")
Heaviest Sub-Section for Field Assembly	33 lbs.	56 lbs.	45 lbs. (8"); 62 lbs. (10")
Total Shipping Weight *(approx.)*	73 lbs.	109 lbs.	94 lbs. (8"); 122 lbs. (10")
#1220 Field De-rotater	—	*optional*	*optional*
Equatorial Wedge Latitude Range	23° to 64°	23° to 64°	23° to 64° (8"); 24° to 65° Superwedge (10")
Field Tripod Height [Note 3]	30" to 44" variable	30" to 44" variable	30" to 44" variable

[1] LX90 and LX200GPS models may alternatively be powered from an automobile cigarette lighter plug, using the #607 Power Cord. From a 115v AC home outlet the LX90 may be powered by using the #541 AC adapter, or the LX200GPS by using the #547 AC adapter. The #607, #541, and #547 include 25 ft. cords. [2] All Pyrex glass used in Meade Schmidt-Cassegrains and Maksutov-Cassegrains is of Grade-A quality, fine-annealed. [3] The standard equatorial wedge adds approx. 9", and the Superwedge approx. 12", to the stated tripod heights. Wedges are supplied optionally with the 8" LX90 and with 7", 8", and 10" LX200GPS models.